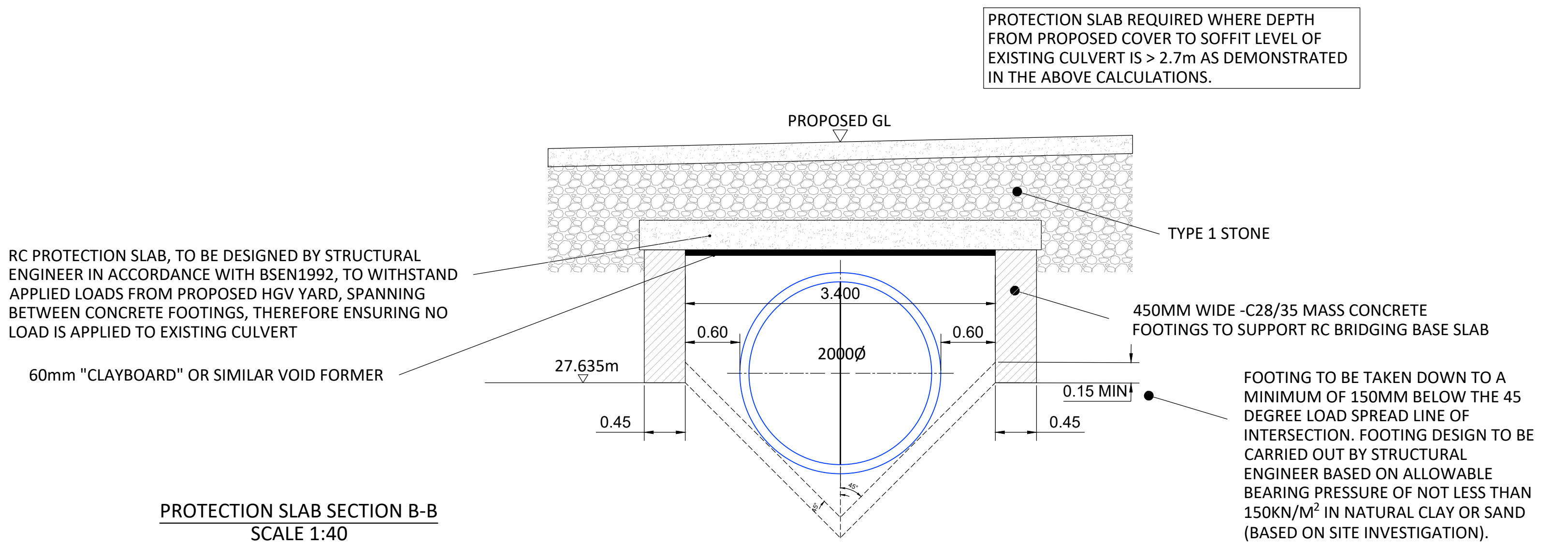
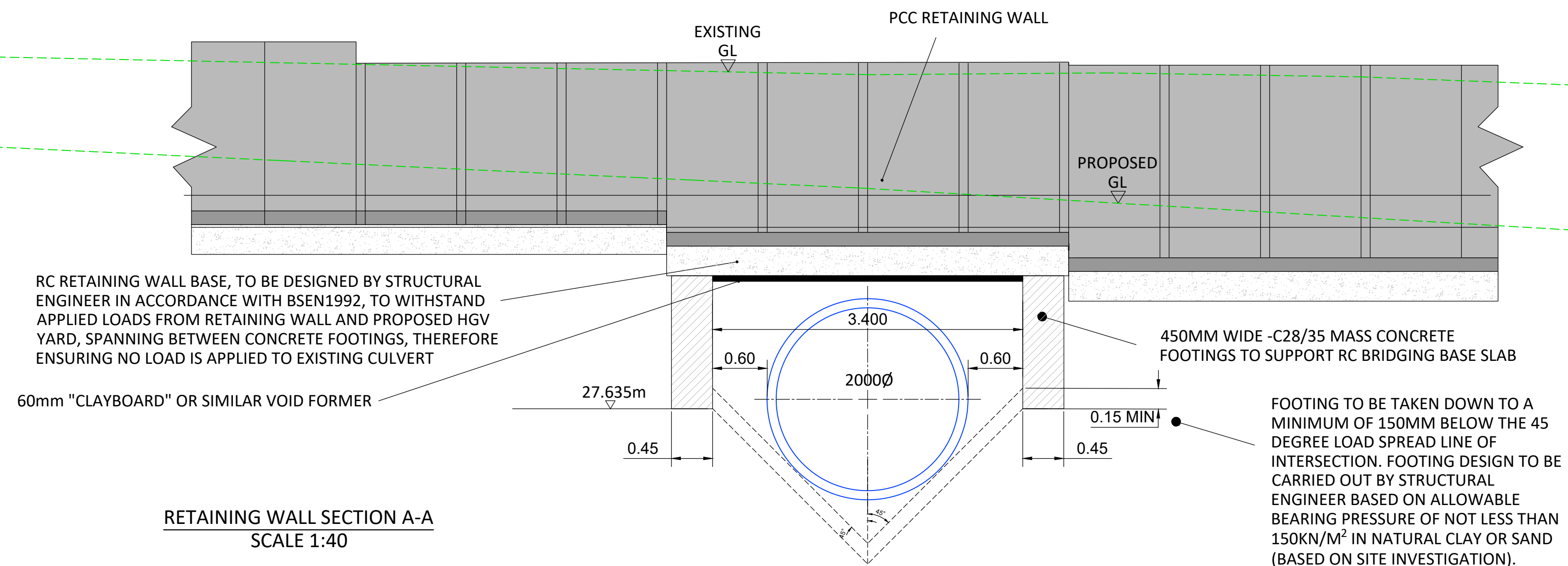
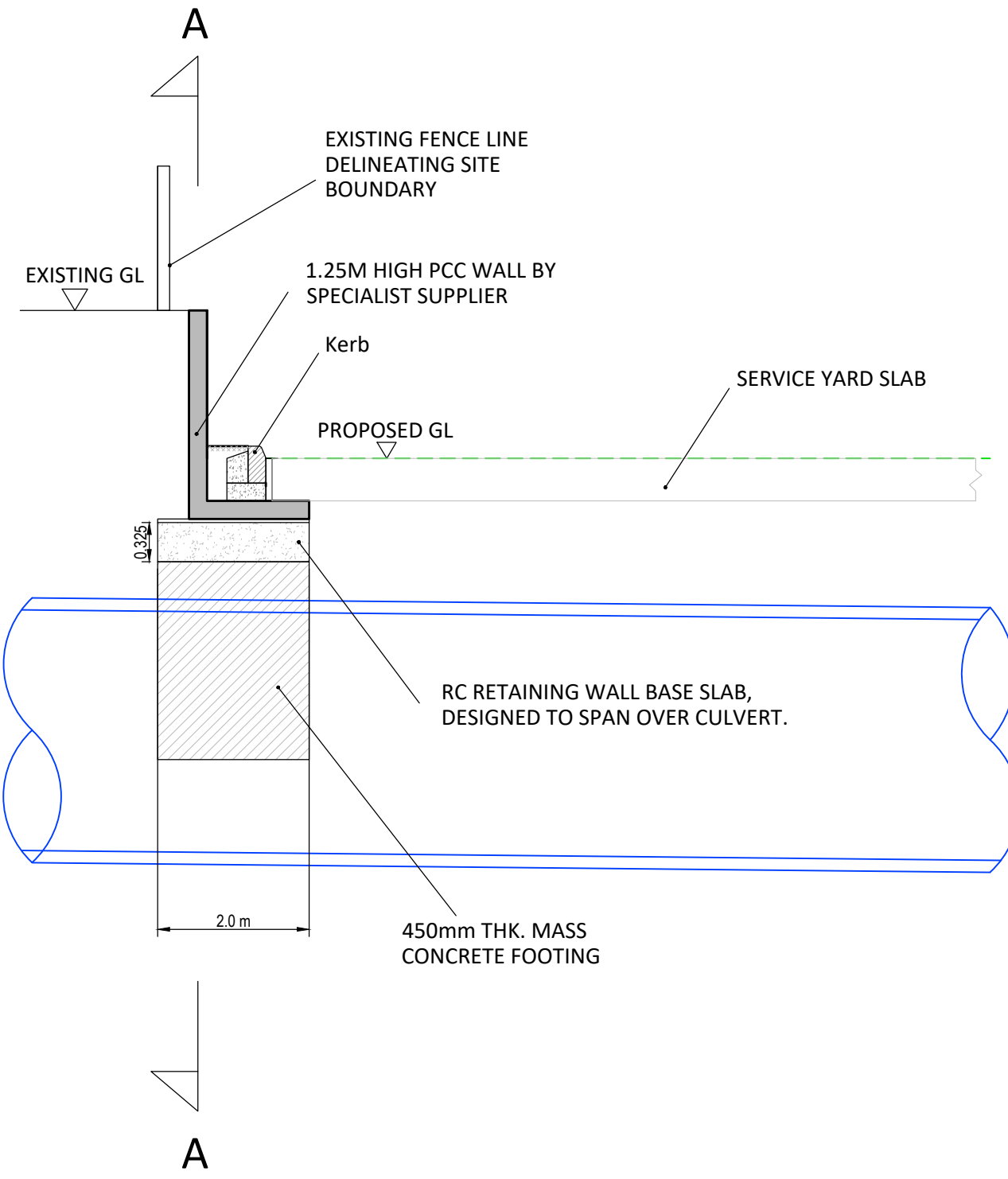
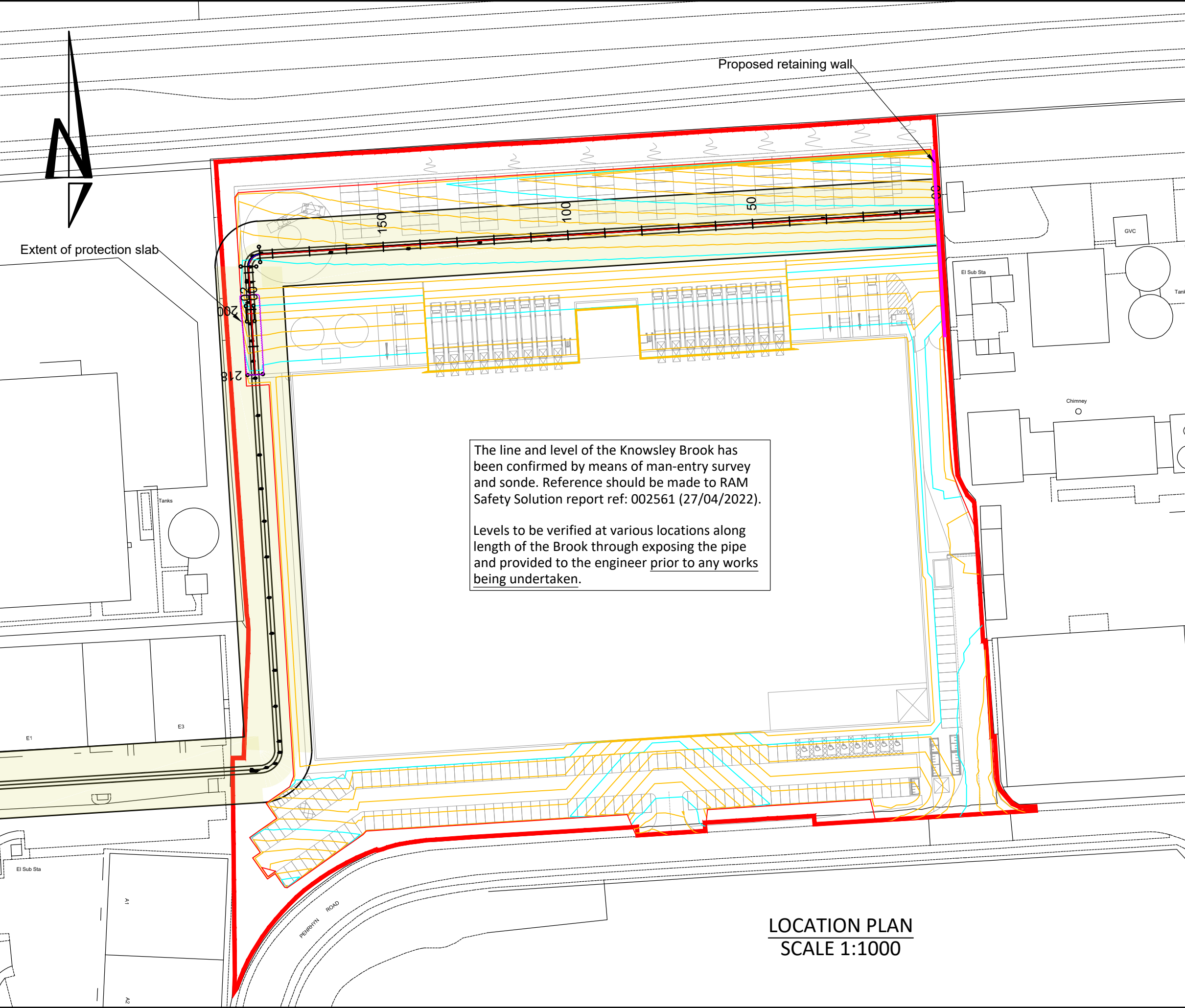




#### Design Commentary

This drawing is intended to demonstrate that the proposed loading on the existing EA culvert will not exceed the existing loading.

The culvert current lies below an area of previous industrial development. The previous structures and hardstandings have been removed. Ground levels will be lowered / raised as required above the culvert to achieve the required development levels. The culvert will be under a proposed area of HGV yard with reinforced concrete pavement. A retaining wall will be constructed above the culvert on the eastern boundary.

The long section on this drawing shows that the maximum ground level above the culvert is 3.614 m at chainage 217m. Taking the soil density as 18kN/m³, the maximum pressure currently exerted on the culvert is 3.6'18 = 64.8 kN/m².

Surveys have been carried out, demonstrating that the culvert construction and condition is the same over the full length. Therefore, this assessment is made on the basis that the culvert can withstand the maximum pressure applied at any point along its length.

#### Proposed Retaining Wall Location

Where the proposed retaining wall is above the culvert, the design of the wall foundation will include a reinforced concrete bridging slab, to be designed in accordance with BSEN1992 to span over the culvert, with loads being transferred to the ground each side of the culvert with mass concrete trench footings. Therefore, no additional loading will be applied to the culvert at this location.

Location where pressure exerted on culvert post development is more than 64.8 kN/m²

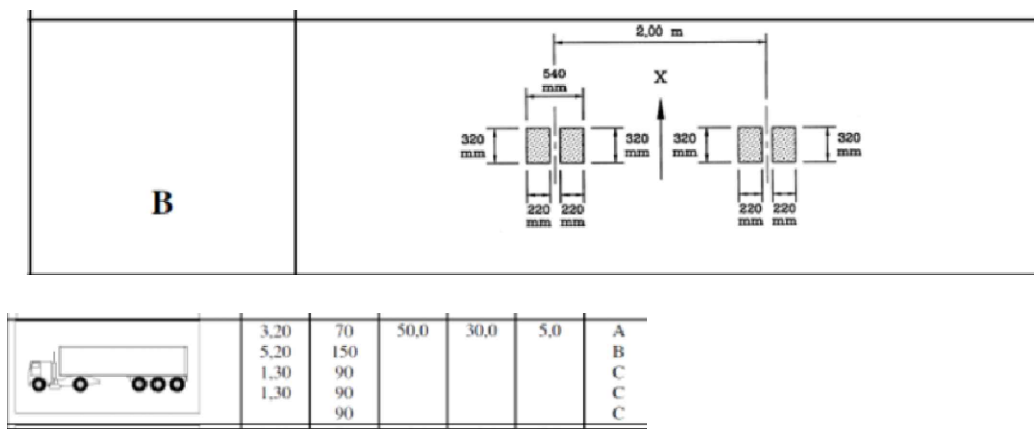
At this location a bridging slab will be provided similar to proposed at the retaining wall location, such that no additional loading will be applied

Location where pressure exerted on culvert post development is less than 64.8 kN/m²

Here, the wheel load diagrams and calculations on this drawing demonstrate that the applied pressure on the culvert due to HGV wheel loads, with load spread through the concrete pavement and at 45 degrees through the ground below will not exceed the pressure currently being exerted on the culvert due to weight of soil. Therefore there will be no increase in loading on the culvert compared with the previous ground pressure.

This assessment has been carried out by Jordan McGlacken MEng, checked by Mark Graham BEng CEng MICE.

#### EXTRACTS FROM BS EN 1991-2



#### LOADING ON THE PIPE

- Taking a 3.5m notational lane width.
- Maximum 150 kN HGV axle load, taken from BS EN 1991-2.
- Assumed 0.4m THK R.C. Slab in yard with a unit weight of 24 kN/m³. The R.C. slab in yard will be 0.2m THK but has been taken as 0.4m THK for the calculations (conservative approach).
- 0.32m Width of wheel, with 0.5m load spreading from the slab.

$$P1 = \text{pressure from soil} = [(18 \times D) + (24 \times 0.4)]$$

$$P2 = \text{pressure from axle} = \frac{150}{[1.32 + (2 \times D)] \times 3.5}$$

$$P = P1 + P2$$

#### EXISTING WORST CASE LOAD ON PIPE

- Maximum depth between existing Ground level and Soffit is 3.614m (see chainage 217m on long section).
- Unit Weight of the Soil is 18 kN/m³

$$\text{Maximum existing pressure on culvert} = 3.6m \times 18 \text{ kN/m}^3 = \mathbf{64.80 \text{ kPa}}$$

#### MAXIMUM DEPTH WITHOUT BRIDGING SLAB

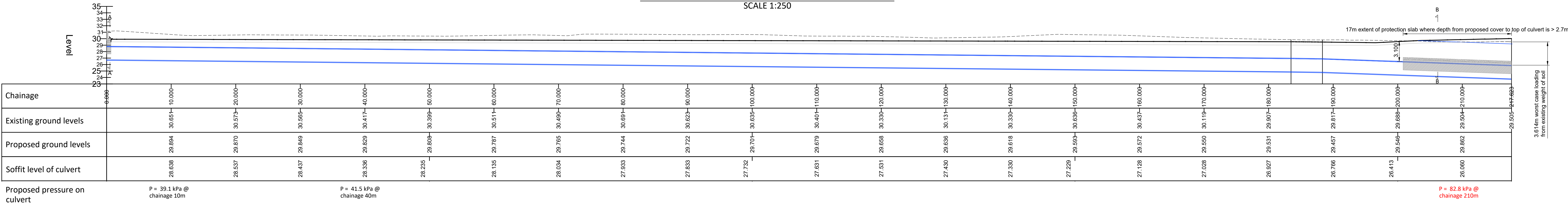
- Future loading on culvert based on 3.11m depth to cover:

$$P = [(18 \times D) + (24 \times 0.4)] + \left[ \frac{150}{[1.32 + (2 \times D)] \times 3.5} \right]$$

$$P = [(18 \times 2.71) + (24 \times 0.4)] + \left[ \frac{150}{[1.32 + (2 \times 2.71)] \times 3.5} \right] = \mathbf{64.74 \text{ kPa}}$$

- Therefore, where depth of cover to soffit of culvert is greater than 3.1m (conservative), the force on the culvert will exceed the maximum existing force on the culvert produced by the ground above, and a bridging protection slab is required.
- Where the depth of cover is less than 3.1m, calculations confirm that the force applied on the culvert is always less than 64.8 kPa, and a bridging slab is not required.

#### LONGSECTION THROUGH LENGTH OF EXISTING CULVERT IN YARD SCALE 1:250



|                                                                                                                                            |  |
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| IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:                  |  |
| CONSTRUCTION                                                                                                                               |  |
| MAINTENANCE                                                                                                                                |  |
| DEMOLITION                                                                                                                                 |  |
| IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT     |  |
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|     |          |     |                                                                |       |
|-----|----------|-----|----------------------------------------------------------------|-------|
| P3  | 04/07/22 | JAM | Diagrams and design commentary added<br>Drawing title amended. | MG    |
| P2  | 17/05/22 | JAM | Developed detail                                               | MG    |
| P1  | 11/05/22 | JAM | First Issue                                                    | MG    |
| REV | DATE     | BY  | REVISION                                                       | CHK'D |

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PROJECT  
PENRHYN ROAD, MERSEYSIDE  
KNOWSLEY BUSINESS PARK

#### DRAWING TITLE ASSESSMENT OF LOADING ON EXISTING EA CULVERT

|                                                |                                      |                        |
|------------------------------------------------|--------------------------------------|------------------------|
| OUR PROJECT NUMBER<br><b>21065</b>             | DRAWING STATUS<br><b>PRELIMINARY</b> | OFFICE<br><b>NORTH</b> |
| SCALE @ AD<br><b>VARIES</b>                    | DATE<br><b>11.05.2022</b>            | DRAWN BY<br><b>JAM</b> |
| DRAWING No<br><b>21065-BGL-XX-XX-DR-S-0203</b> | CHECKED BY<br><b>MG</b>              | REV                    |

21065-BGL-XX-XX-DR-S-0203 P3